Appendix 3

Brief Descriptions of Current and Historic Monitoring Programs within the SFAN Parks

Monitoring Programs in the Golden Gate/Point Reyes Administered Parks

Monitoring programs currently exist under the parks vital signs model developed in 1997 that include the marine, freshwater, and terrestrial plant and vertebrate components. Several threatened or endangered (T&E) species, plant communities, water quality, air quality, geologic processes, and non-native invasive plants and animals are currently monitored. Most of these monitoring programs require a review of protocols before being included in the SFAN long-term monitoring program. Six programs were funded for monitoring activities as their protocols were more fully developed and peer reviewed. These include: Prairie Falcons at PINN; Landbirds at GOGA, JOMU, PINN and PORE; Western Snowy Plovers at GOGA and PORE; Stream fish assemblages including salmonids at GOGA, JOMU, PINN and PORE; Northern Spotted Owls at MUWO and PORE; and Pinnipeds at GOGA and PORE. These six indicators have long-term datasets and established programs in place at Network parks. Peer review of the six protocols has either been completed or is underway.

Air/Meteorology: Point Reyes, a Class I Air Quality park, has monitored air quality for over 20 years. The Interagency Monitoring of Protected Visual Environments (IMPROVE) program has been in operation since 1988 at the North District Ranger Station. Three types of visibility measurements are undertaken in the IMPROVE network: particle (or aerosol), scene, and optical. The mass and chemical composition of the suspended fine particulate matter (PM-2.5) and the mass of coarse particulate matter (PM-10) is measured by the particle monitor. A history of the station and PORE data are located at the IMPROVE website. PORE operates a digital camera at the lighthouse at many parks to help educate the public on air quality issues. These cameras are linked to the internet and often show the effects of air pollution such as visibility impairment. Because these cameras are typically located near air quality monitoring sites, the camera web pages display other information along with the photo such as current levels of ozone, particulate matter, or sulfur dioxide air pollutants, visual range, and weather conditions. The digital photos are usually updated every 15 minutes, while air quality data values are revised hourly. The photos are available at: http://www2.nrintra.nps.gov/air/webcams/index.htm.

The Bay Area Air Quality Management District (BAAQMD) operates an air quality station at Fort Cronkhite at GOGA that monitors dioxin.

Point Reyes NS has maintained weather records from the Point Reyes Lighthouse since approximately the 1910's. Rainfall data at Bear Valley Headquarters have been kept since 1964. The current weather station at Bear Valley records rainfall, wind speed, wind direction, relative humidity, and temperature. Additional weather stations were recently deployed on Inverness Ridge (PORE), Mt. Wanda (JOMU), EUON and a station is expected to be deployed on Sweeney Ridge (GOGA). Rainfall data also are currently collected at the lighthouse and in the Olema Creek, Pine Gulch Creek, Redwood Creek, and Easkoot Creek Watersheds. A database is being created for weather data within the parks.

There are also weather stations in Point Reyes that are managed by other agencies (such as the U.S. Coast Guard, Scripps Institute of Oceanography, and the Department of Health Services).

Geologic Resources: Because the parks lie along several earthquake faults, the USGS Geological Resource Division monitors seismic events continuously at Point Reyes and Golden Gate.

Water Resources: Comprehensive water quality monitoring is currently ongoing at PORE and GOGA. This includes ambient monitoring at 33 sites in PORE (since 1999) and 23 in GOGA (since 2000). Additionally, monitoring has also been conducted at about 15 sites in PRES within various time frames. Aquatic bioassessment for macroinvertebrates has been conducted at 10 sites within PORE, as well as sites within GOGA and PINN.

Water quality parameters monitored included temperature, pH, dissolved oxygen, salinity, specific conductance, nitrates, nitrites, orthophosphates, fecal/total coliform, and total suspended solids. Detailed results of PORE monitoring efforts are presented in the Point Reyes National Seashore Water Quality Monitoring Report (Ketcham 2001). Results indicate that 33% of samples exceeded the non-contact recreational limit for fecal coliform (2,000 MPN/100mL). Ammonia levels toxic to aquatic species occurred in 3.1% of the samples. However, the majority of samples were collected during winter storm events when non-point source pollution from agricultural areas (including dairy and beef operations) occurred. Under most other conditions, water quality criteria were met. Management actions stemming from the water quality monitoring program have been implemented at pastoral sites within PORE.

Recreational monitoring programs are in place at PORE and GOGA. The Marin County Public Health Department (coordinating with PORE staff) has been monitoring three beaches at the Seashore. Three additional recreational water bodies have been monitored by PORE since 1999. Four beaches have been monitored by NPS staff at GOGA (since 1998). Four additional GOGA recreational sites have been monitored by the City and County of San Francisco.

Beaches were typically monitored weekly or bi-weekly from May through November with monthly monitoring the remainder of the year. One pond at PORE was posted for exceeding contact recreational fecal coliform standards (200 MPN/100mL). PORE staff also assisted in monitoring efforts within the Tomales Bay Watershed. These efforts resulted in postings at four sites within the watershed (but outside of the Seashore).

Vegetation: Vegetation mapping for all of the parks has been conducted over the past five years and is near completion with an accuracy assessment in final draft. Many of the plots developed for this map could be used for long-term monitoring. Several rare plant species have been monitored within the parks over the past several years. Each park has a weed management database, which is used to document occurrences (species, location

and extent), plan restoration and record removal efforts. PORE has conducted rangeland monitoring plant composition and biomass since 1998.

Wildlife: Primarily species of special concern or federally listed species have been monitored annually in the last 5 + years within the parks (SFAN Monitoring Plan, Appendix 2), including Northern Spotted Owl, Western Snowy Plover, coho salmon and steelhead trout, mission blue butterfly, Myrtle's silverspot butterfly and Bank Swallows. At selected sites, red-legged frog populations have been monitored since 1993. The Tule elk population at PORE has been extensively monitored since 1972; the exotic fallow and axis deer populations have been surveyed sporadically. There are also several long-term monitoring studies (10-30 years) of landbirds by PRBO Conservation Science (PRBO) at select locations in the parks and of waterbirds/shorebirds by the Audubon Society and PRBO (see **Landbirds** below). The U.S. Fish and Wildlife Service monitored the Common Murre breeding population at Point Reyes Headlands from 1996 – 2002. Monthly counts of Townsend's big-eared bats have been monitored at two locations since 1990.

Landbirds: Landbird monitoring has been conducted in PORE and GOGA at various levels of intensity, with various combinations of methods, and in several seasons depending on study site for more than 30 years.

Intensive landbird monitoring—constant effort mist netting and nest monitoring—has been ongoing in PORE at a single site (Palomarin Field Station) since 1966 and 1980, respectively. Mist netting occurs year round; nets are operated in a standardized fashion; run six days per week from 1 April to 27 November and three days per week for the remainder of the year; data are contributed to the Monitoring Avian Productivity and Survivorship (MAPS) program (DeSante et al. 2001). Nest monitoring takes place within California coastal scrub; study species are color banded; all plots have grid stakes; territories of all species are mapped; vegetation around each nest is assessed; data are contributed to the Breeding Biology Research and Monitoring Database (BBIRD) program (Martin et al. 1997). Point counts are also conducted annually at Palomarin.

The monitoring efforts at Palomarin have already contributed greatly toward meeting the objectives listed below (e.g., DeSante and Geupel 1987, Johnson and Geupel 1996, Chase et al. 1997, Gardali et al. 2000, Chase 2002, Ballard et al. 2003, Gardali et al. 2003).

In addition to Palomarin, MAPS stations are run at four sites, BBIRD nest monitoring at one site (though several have had nest monitoring in the past), point counts at all sites, and territory mapping at one site in PORE and GOGA. Additional survey locations were added during the inventory phase of the NPS Natural Resource Challenge.

Marine: Nearshore ocean productivity is monitored by University of California Bodega Marine Lab using Coastal Ocean Dynamics Application Radar (CODAR) and an Acoustic Doppler Current Profiler (ADCP) between Point Reyes Headlands and Bodega Head. Intertidal communities have been monitored at select sites along the shorelines of GOGA and PORE by the respective parks and by NOAA for at least the since 1996.

Marine surveys by NOAA have been conducted annually from Point Arena to Monterey Bay since 1985. This dataset includes seabird, pinniped, and cetacean sightings in the waters of PORE and GOGA. Pinnipeds have been counted biweekly at Point Reyes headlands since 1995 and the breeding populations of harbor seals and elephant seals have been monitored at PORE and GOGA since 1976 and 1981, respectively.

Multi-Species Inventory and Monitoring at Point Reyes NS: An inventory program for amphibians, reptiles, and small/medium mammals was implemented at Point Reyes National Seashore in 1998. The project was funded by USGS monitoring funds and more recently, by SFAN I&M program funds. The goal of this work has been to determine whether fairly simple, yet scientifically based techniques could be used to track vertebrate populations across a variety of habitats including grasslands, riparian, scrub, and coniferous forests. Using a combination of three types of traps, artificial cover boards, and remote-triggered cameras, the presence of 58 species of vertebrates has been documented during the first three years of operation. The protocol worked well in the variety of habitats sampled and could easily be applied to other situations. The program is cost effective and can be implemented with a single field person. Modifications to the trapping scheme are being tested to further improve efficiency and effectiveness.

Multi-Species Inventory and Monitoring at Golden Gate NRA: Begun in 1988, GOGA started surveying small vertebrate amphibians, reptiles and mammals in many habitats (Howell 1992). The protocols applied include a stratified random sampling design based on habitat type as classified by the California Department of Fish and Game (Mayer and Laudenslayer 1988). This project was funded by a number of sources over the years including GOGA, Earthwatch, and the California Department of Fish and Game. Surveys have been conducted using line transects, variable circular plots, live traps, Sherman box traps. Pitfall traps are used if determined necessary based on field observations. Over 500 plots have been sampled and an additional 20 plots in upland habitat, forests, and around coastal lagoons will be completed.

Current Monitoring Programs specific to Pinnacles NM

Air/Meteorology: The NPS Air Quality Office and EPA established a monitoring station near the east entrance of the park in 1987. An air clarity study has been completed, but particulate and ozone monitoring continues. Despite occasional hazy days, the air quality at the Monument is a defining feature and an important resource.

The Monument has an official weather station located at the base of Condor Gulch that was established in the 1930s. This station has provided long-term data, but the spatial variation in weather and climate has not been examined. The air quality station also provides meteorological data, but data are available only after the station's establishment in 1987.

Bats: In 1997 a colony of Towsends big-eared bats was discovered in the Bear Gulch Caves, one of the most heavily used areas in the park. The caves were closed and monitoring of the population was initiated. It was determined that the caves were used by both a maternity colony and as a hibernaculum for the bats. Monitoring continued, and a

management plan for the caves was developed to allow use of the caves during times when the colony of bats would be least affected. An integral part of this management plan is the continued monitoring of the bats in the caves to ensure a healthy population is maintained in the park.

Fire: In 1989 and 1990 fire monitoring plots were established to monitor the effects of prescribed burning on the vegetation of the park. Since they were established only a few prescribed burns have been accomplished, but data for these plots could be used to determine long-term changes in vegetation.

Pigs: In 2002 a monitoring study began at Pinnacles to look at the effects of pigs and pig rooting on various aspects of the ecosystem. This project is very closely tied to our pig eradication project, with the hope that some changes could be detected over time with the removal of the pigs.

Geology: Seismic activities in the Monument continue to be monitored by the US Geological Survey. There is a seismometer along the Chalone Creek Fault and a corresponding seismometer in the Beach Gulch Visitor Center that provides a continuous record of seismic activity. The purpose of continued monitoring is to learn more about earthquake phenomena. The information provides staff with data to illustrate and interpret the natural processes still shaping the Pinnacles.

Raptors: Pinnacles National Monument has monitored cliff nesting raptors and the impacts of rock climbing on their nesting success since 1987. Raptor monitoring data is collected through the breeding season from January to July, and includes: nesting phenology, timing of breeding cycle, foraging ecology, reproductive behavior, reproductive success, and the impact rock climbing has upon these. Raptor advisories and climbing/off-trail hiking closures go into effect every year during the raptor breeding season, to protect nesting birds of prey from human disturbance. The monitoring data that is collected is summarized annually and used to determine the status of the population and refine management strategies in the future.

Small Birds: The small bird population at Pinnacles was initially studied over a three year period of time from 1983-1985 by Avery and VanRiper (1986). This was replicated from 1997-1999 by Buranek and Fesnock (1999), including an analysis comparing the data from the first survey. Results indicated that the small bird community at Pinnacles is quite dynamic, with more variation between years than between surveys in some cases. Continued monitoring of the small bird populations will be valuable for future management in the park.

Exotic Plant Species: Pinnacles has been systematically removing and monitoring invasive non-native plants since 1997. Information on the location of each species as well the total number of plants removed is documented. Monitoring of invasive non-native plant species will allow managers to not only determine the effectiveness of the treatments, but will document the areas that have been and may be subject to future invasions.

Night Skies: Baseline data for monitoring dark night skies were collected at Pinnacles from 2000-2003. Continued periodic monitoring will help determine the condition of our dark night skies and will help articulate the value of this vanishing resource and the effects that it loss will have on the biological resources in the park.

Climbing Areas: Monitoring was conducted on climber access/staging areas in 1980s and again in the late 1990s. This monitoring program documents the extent of disturbance associated with climbing activities and will help inform the park during the development of the climbing management and wilderness management plans.

Oak Regeneration: Plots for long-term monitoring of oak recruitment in both valley oak and blue oak woodlands in the park were established in 1999. Data documents the presence and condition of seedlings as well as the presence of associated species and pig damage in the areas.

Trail Use: In 1999 trailmaster counters were installed on the major trails of the park to monitor visitor use. Data from these counters documents seasonal variations in use as well as weekly and daily use patterns. The park continues to collect this data, and intends to utilize the data when developing alternatives during the revision of the GMP.

Stream Surveys: The streams in the park have been surveyed annually since 1998 for aquatic vertebrates, with special emphasis on California red-legged frog populations. A population of exotic fish was removed from the park in 1998, and one of the primary reasons for the annual surveys is to check for the presence of fish. Beginning in 2001 more detailed surveys occurred in conjunction with establishing baseline data for the inventory and monitoring program.

Literature Cited

Avery, M. L., and C. van Riper III. 1986. Bird community survey at Pinnacles National Monument. CPSU/UCD Tech. Rep. No. 24.

Ballard, G., G. R. Geupel, N. Nur, and T. Gardali. 2003. Long term declines and decadal patterns in population trends of songbirds in Western North America, 1979 – 1999. Condor **105**:737-755.

Buranek, S. and A. Fesnock. 1999. Small bird summary report: comparing two avifaunal surveys (1983-1985 and 1997-1999) at Pinnacles National Monument.

Chase, M. K. 2002. Nest site selection and nest success in a Song Sparrow population: the significance of spatial variation. Condor **104**:103-116.

DeSante, D. F. and G. R. Geupel. 1987. Landbird productivity in central coastal California: the relationship to annual rainfall and a reproductive failure in 1986. Condor **89**:636-653.

DeSante, D. F., K. M. Burton, P. Velez, and D. Froehlich. 2001. MAPS Manual: 2001 Protocol. The Institute for Bird Populations, Point Reyes Station, CA.

Gardali, T., G. Ballard, N. Nur and G. R. Geupel. 2000. Demography of a declining population of Warbling Vireos in coastal California. Condor **102**:601-609.

Howell, J. A. 1992. Coastal scrub and prairie wildlife inventory, Golden Gate National Recreation Area, California. Symposium on Biodiversity of Northwestern California, Santa Rosa, CA, October, 1991:134-140.

Johnson, M. and G. R. Geupel. 1996. The importance of productivity to the dynamics of a Swainson's Thrush population. Condor **98**:133-141.

Ketcham, B. 2001. Point Reyes National Seashore Water Quality Monitoring Report May 1999-May 2001.

Martin, T. E., C. R. Paine, C. J. Conway, W. M. Hochachka, P. Allen, and W. Jenkins. 1997. BBIRD (Breeding biology research and monitoring database) field protocol. Montana Cooperative Wildlife Research Unit, University of Montana, Missoula, MT.

Mayer, K.E., and W.F. Laudenslayer, Jr. eds. 1988. A guide to the wildlife habitats of California. Calif. Dept. of Fish and Game, Sacramento, California.